METHOD, DEVICE AND SYSTEM FOR HEATING

TECHNICAL FIELD

The present invention relates to a method for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, according to the preamble of claim 1. The present invention also relates to another method for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, according to the preamble of claim 8. The present invention further relates to a method for purifying gases according to the preamble of claim 14. The present invention still further relates to a method for extinguishing fires according to the preamble of claim 17. The present invention further relates to a device for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, according to the preamble of claim 19. The present invention still further relates to a system for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, according to the preamble of claim 31. The present invention further relates to a system for purifying gases according to the preamble of claim 46. The present invention also relates to a system for extinguishing fires according to the preamble of claim 52. The present invention finally relates to a device for extinguishing fires according to the preamble of claim 56.

BACKGROUND

In boiler houses sulphur coating is formed on the inside of the boilers, i.e. extremely hard slag which is very difficult to remove. By conventional methods water is flushed in the boiler in order to unlace the slag, which is then scraped off. This is done by chimney cleaners and is very time consuming and does not provide a very

good result. It is further a physically demanding task and expose the workers to hazards.

In exhaust air ducts, such as e.g. kitchen ducts, fat originating from food products and the like gets stuck on the inside of the ducts, on the bottom part and on the walls. The fat gets extremely hard and is very difficult to remove. The cleaning of the ducts is performed manually by conventional methods. The workers have to crawl inside the duct and scrape off the fat and collect it in buckets or the like. In buildings with several floors a narrow elevator is constructed where the worker sits and performs the cleaning. Also this does not give a satisfactory result and is a quite difficult task for the workers.

In the food industry, i.e. by chocolate manufacturing, slag is formed in the chocolate channels. In order to remove the slag products heating pistols are used, but they do not supply enough energy and are thus inefficient and do not give a satisfactory result. By releasing steam from boilers into the room attempts are made to clean the channels, but as the steam has to travel a long way it is not efficient at all.

In industrial chimneys the soot gets stuck on the inside of the chimney. The chimneys are cleaned by conventional cleaning, performed by chimney cleaners. This is a quite tricky and time consuming task, which can be physically demanding and hazardous for the workers. Another way of removing soot is to use ultrasonic sound, which, however, is not an efficient method.

In drainage systems today, all cast iron systems are cleaned by high pressure flushing with water using a pressure greater than 100 bar. As a consequence they tend to break in joints, sealing joints etc. on occasions. In apartments the remains are discharged into the sewer systems, which is a problem.

The marine industry suffers from basically the above problems. They have kitchen ducts, drainage systems, chimneys etc.

By manufacturing of medicine in large tanks, the tanks are afterwards cleaned by means of hot water under high pressure. A very large amount of water is consumed and the result is not particularly good.

In the paper pulp industry the paper pulp gets stuck in e.g. the tanks, the conveyor belt where the pulp is dried, actually basically the whole line of production. The paper pulp becomes so hard that iron bars are needed to remove the pulp. The same type of problem also occurs by filter manufacturing.

Cleaning of oil in pipelines which gets stuck therein is currently done by using a sleigh or the like which cuts away the slag from the inner walls. By this method only a certain amount is removed due to e.g. the pipes not having an exactly circular shape. In developing countries the removing is done manually, which is very hazardous from an occupational point of view. In some cases the pipelines are simply replaced.

A problem by drilling in oil wells is that the boring bars tend to get stuck by the oil flowing down in the bore holes. There is a thermal rising force from the ground heat (hot air) rising in the holes. The rising air has a certain speed, which results in a cooling effect, cooling down the oil in the bore holes, making the oil sticky, resulting in the boring bars getting stuck. There are no efficient methods to solve this problem.

Shale oil lies under ground as bitumen. There are two known ways of extracting the oil. Either by open cut mine or by heating up the oil sand or by heating up or diluting the oil sand so that it becomes sufficiently fluid to be pumped up.

Both methods have major environmental disadvantages. Open cut mines require that two tons of tar sand is dug up for each barrel (159 litre) of oil produced. Only one fifth of the reserves of oil shale can be extracted with this technique. An army of trucks, trenching machines and bulldozers, which themselves require a lot of energy, are needed in order to excavate an area of the size of a large football ground every second day. After having extracted the shale oil the same operation is needed to fill up the open cut mine and restore nature. By using steam or chemicals for making the bitumen fluid, large risks for damaging the ground water appear. In order to extract shale oil in shale oil reserves using steam, steam is inserted into the ground in order to heat up the bitumen, which then becomes fairly liquid and can be retrieved. The steam is produced by large generators, which require a lot of electrical power, making the oil very expensive.

When an oil tanker sinks, the water is often so cold that oil spill sinks and eventually lies on the bottom. This makes it very difficult to collect the oil.

It is also quite difficult to collect the oil in an oilslick. One way of preventing the oilslicks from drifting away is to provide a barrier around the oilslick, which has a certain depth, e.g. 2 meters. The problem of removing the oil in an efficient way still remains.

By fire fighting, the fires are mostly put out with water. A problem is that after the fire is put out the facility is soaked with water leading to large water damages. Another problem e.g. in large buildings such as skyscrapers the water is flushed from above as the ladders will not reach. This is not very efficient as the water turns into steam and is pushed away before reaching the core of the fire.

Another problem by oil drilling is that fires occasionally occur in the bore holes, which fires are difficult to extinguish. A solution to this problem is to blow up the

bore hole to extinguish the fire. A disadvantage with this solution is that the bore hole is destroyed.

OBJECTS OF THE INVENTION

One object of the present invention is to provide a method for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, such that heating becomes more efficient.

Another object of the present invention is to provide a device for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, such that heating becomes more efficient.

Yet another object of the present invention is to provide a system for heating by means of a gaseous medium comprising steam, said steam being produced from water, energy for heating the water being provided by burning a fuel, such that heating becomes more efficient.

A further object of the present invention is to provide a method for purification of gases, said gases being exhaust gases, non-combusted gases or the like, such that said gases are substantially reduced.

A still further object of the present invention is to provide a system for purification of gases, said gases being exhaust gases, non-combusted gases or the like, such that said gases are substantially reduced

Another object of the present invention is to provide a method for extinguishing fires in oil bore holes without destroying said bore holes.

Yet another object of the present invention is to provide a system intended for extinguishing fires in oil bore holes without destroying said bore holes.

A further object of the present invention is to provide a device intended for extinguishing fires in oil bore holes without destroying said bore holes.

SUMMARY OF THE INVENTION

These and other objects, apparent from the following description, are achieved by methods, a device and a system for heating by means of a gaseous medium comprising steam which is of the type stated by way of introduction and which in addition exhibits the features recited in the characterising clause of the appended claims 1, 8, 19 and 31, a method and system for purifying gases which is of the type stated by way of introduction and which in addition exhibits the features recited in the characterising clause of the appended claims 14 and 46, a method, system and device for extinguishing fires which is of the type stated by way of introduction and which in addition exhibits the features recited in the characterising clause of the appended claims 17, 52 and 56. Preferred embodiments of the inventive methods, devices and systems are defined in appended sub claims 2-7, 9-13, 18, 20-30, 32-43, 47-51, 53-55 and 57-58.

One advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of removing slag from the inside of the boilers in boiler houses or the like which is quick, efficient and does not lead to any occupational hazards.

Another advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way

of removing fat from the inside of exhaust air ducts, such as kitchen ducts or the like, which is quick, efficient and does not lead to any occupational hazards.

Yet another advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of removing slag from the inside of channels by food manufacturing, such as chocolate channels by chocolate manufacturing or the like, which is quick and efficient.

A further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of removing soot from the inside of industrial chimneys or the like which is quick, efficient and does not lead to any occupational hazards.

A still further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of removing slag from the inside of containers by medicine manufacturing or the like which is quick and efficient.

Another advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of removing hard paper pulp from the inside of containers by paper pulp manufacturing or the like which is quick, efficient and does not lead to any occupational hazards.

Yet another advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of cleaning drainage systems such as cast iron systems or the like in apartment facilities or the like which is quick and efficient and at the same time eliminates the risk of damaging the pipes.

A further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of clearing oil stuck in pipelines, which is quick and efficient.

A still further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of preventing boring bars to get stuck by drilling in oil wells.

Another advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of extracting shale oil in shale oil reserves in an efficient and power saving way.

Yet another advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of collecting leaking oil from a sunk or sinking oil tanker in an efficient way.

A further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of collecting the oil from an oilslick in an efficient way.

A further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-7 is that it facilitates a way of heating up rooms such as e.g. house trailers which is very efficient and environmental friendly.

A still further advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 1-5 is that it facilitates a way of putting out fires which is efficient and avoids water damages in the facility where the fire has been put out.

Advantages offered by the method according to the present invention as defined in the characterising clause of claim 8 is that it facilitates a way of heating which is very efficient, with practically no loss of energy, and which leads to substantially no releases of exhaust gases to the environment.

An advantage offered by the method according to the present invention as defined in the characterising clause of claim 9 is that filtering of said steam and exhaust gas mixture offers a controlled way of purifying said mixture such that pure water is re-used, which means that the process can be repeated without adding any impurities.

Advantages offered by the method according to the present invention as defined in the characterising clause of claims 10 or 11 is that it facilitates a way of heating buildings which is very efficient, with practically no loss of energy, and which leads to substantially no releases of exhaust gases to the environment.

Advantages offered by the method according to the present invention as defined in the characterising clause of claim 12 or 13 is that it facilitates a way of producing electricity by means of steam turbines which is very efficient, with practically no loss of energy, and which leads to substantially no releases of exhaust gases to the environment.

Advantages offered by the method according to the present invention as defined in the characterising clause of claims 14 or 15 is that it facilitates a way of purifying gases, where said gases may comprise exhaust gases and hot and cold non-combusted gases, which is very efficient, with practically no loss of energy, and which offers a controlled way of collecting impurities from said gases, which leads to substantially no releases of exhaust gases to the environment, and such that pure water may be reused.

An advantage offered by the method according to the present invention as defined in the characterising clause of anyone of claims 17-18 is that it facilitates a way of extinguishing fires in oil bore holes, which way is efficient and avoids damaging said bore holes.

An advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick, efficient and safe way, removing slag from the inside of the boilers in boiler houses or the like.

Another advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick, efficient and safe way, removing fat from the inside of exhaust air ducts such as kitchen ducts or the like.

Yet another advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick and efficient way, removing slag from the inside of channels by food manufacturing such as chocolate channels by chocolate manufacturing or the like.

A further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick, efficient and safe way, removing soot from the inside of industrial chimneys or the like.

A still further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick and efficient way, removing slag from the inside of containers by medicine manufacturing or the like.

Another advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick, efficient and safe way, removing hard paper pulp from the inside of containers by paper pulp manufacturing or the like.

Yet another advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick and efficient way, without damaging the pipes, cleaning drainage systems such as cast iron systems or the like in apartment facilities or the like.

A further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for, in a quick and efficient way clearing oil stuck in pipelines.

A still further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it facilitates a way of preventing boring bars to get stuck by drilling in oil wells.

Another advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for in an efficient and power saving way extracting shale oil in shale oil reserves.

Yet another advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for in an efficient way collecting leaking oil from a damaged oil tanker.

A further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for in an efficient way collecting the oil from an oilslick.

A further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it can be used for in an efficient and environment friendly way, heating up rooms such as e.g. a house trailers.

A further advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 19-30 is that it facilitates a way of putting out fires, which way is efficient and avoids water damages in the facility where the fire has been put out.

Advantages offered by the system according to the present invention as defined in the characterising clause of claim 31-39 is that it facilitates a way of heating, which is very efficient, with practically no loss of energy, and which leads to substantially no releases of exhaust gases to the environment.

An advantage offered by the method according to the present invention as defined in the characterising clause of claims 35 or 37 is that filtering of said steam and exhaust gas mixture offers a controlled way of purifying said mixture such that pure water is reused, which means that the process can be repeated without adding any impurities.

Advantages offered by the system according to the present invention as defined in the characterising clause of claims 40 or 41 is that it facilitates a way of heating buildings, which is very efficient, with practically no loss of energy, and which leads to substantially no releases of exhaust gases to the environment

Advantages offered by the system according to the present invention as defined in the characterising clause of claims 42 or 43 is that it facilitates a way of producing electricity by means of steam turbines, which is very efficient, with practically no

loss of energy, and which leads to substantially no releases of exhaust gases to the environment.

Advantages offered by the system according to the present invention as defined in the characterising clause of anyone of claims 46-51 is that it facilitates a way of purifying gases, where said gases may comprise exhaust gases and hot and cold non-combusted gases, which is very efficient, with practically no loss of energy, and which offers a controlled way of collecting impurities from said gases, which leads to substantially no releases of exhaust gases to the environment, and such that pure water may be reused.

An advantage offered by the system according to the present invention as defined in the characterising clause of anyone of claims 52-55 is that it facilitates a way of extinguishing fires in oil bore holes, which way is efficient and avoids damaging said bore holes.

An advantage offered by the device according to the present invention as defined in the characterising clause of anyone of claims 56-58 is that it facilitates a way of extinguishing fires in oil bore holes, which way is efficient and avoids damaging said bore holes.

These and other advantages of the present invention will be further elucidated in the following description.

DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention will be had upon the reference to the following detailed description when read in conjunction with the accompanying drawings, wherein like reference characters refer to like parts throughout the several views, and in which:

Fig. 1a shows a schematic and partly sectional view of a device for heating by means of a gaseous medium comprising steam according to a first preferred embodiment of the present invention;

Fig. 1b shows a schematic view of a device for heating by means of a gaseous medium comprising steam according to a second preferred embodiment of the present invention;

Fig. 2 shows a schematic view of a device for heating by means of a gaseous medium comprising steam according to an alternative embodiment of the present invention;

Fig. 3 shows the device in fig. 2 attached to a channel configuration;

Fig. 4 shows a schematic view of a system for heating by means of a gaseous medium comprising steam according to an aspect of the present invention;

Fig. 5 shows a preferred application of the system in fig. 4;

Fig. 6 shows an alternative preferred application of the system in fig. 4;

Fig. 7 shows a schematic view of a system for purifying gases according to an aspect of the present invention;

Fig. 8a shows a schematic view of a system for extinguishing fires in oil bore holes according to another aspect of the present invention; and

Fig. 8b shows a detail of the system in fig. 8a.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1a shows a device for heating by means of a gaseous medium comprising steam being produced from water, energy for heating the water being provided by burning a fuel, said fuel being a gaseous medium, for example butane, propane, natural gas or the like, or a liquid medium, for example diesel, oil or the like, or a solid medium, for example coal, pellets, peat, oilshale, coke, wood or the like, according to a first embodiment of the present invention. The device 1 comprises a container 2, a burner 3 for burning said fuel, e.g. a gas burner 3, attached to the bottom of said container 2, for introducing heat into said container 2, and a water inlet 4 at the lower part of the container 2, preferably a pipe 4, for introducing water, and a reducing valve 5 connected to the pipe 4, said pipe 4, when located inside the container 2, preferably having a helical shape rising upwardly in the container, and a pressure chamber 6 to the upper part of which the pipe 4 is connected, in which pressure chamber 6 water is intended to be introduced and boiled. The device further comprises an outlet 7, preferably a pipe 7, in the upper part of the pressure chamber 6, and an injection chamber 8 to the inner cavity 8a of which the pipe 7, via a safety valve 9 and a vent passage 10, said valve 9 and passage 10 preferably being located outside of the container 2, is connected. The device further comprises an overflow pipe 11 connected to the safety valve 9, said pipe extending down back into the lower part of the container where it is arranged to put out the flame from the burner 3. The injection chamber 8 further has an outer cavity 8b surrounding the inner cavity 8a, said chamber 8 being attached to the top of the container 2. The device further comprises a flame guard 12, preferably a perforated plate or the like constituting the top of the container 2 and the bottom of the injection chamber 8. The steam is intended to be introduced into the inner cavity 8a of the injection chamber 8 via the pipe 7. The exhaust gas is intended to be introduced into the outer part 8b of the injection chamber 8 via the flame guard 12. The device further comprises a mixing chamber 13 constituting the upper part of the injection chamber, where steam, via openings 13a in the inner part 8a of the injection chamber 8, is intended to be introduced in the outer

part 8b of the injection chamber 8, and a steam heating hose 14 connected to the mixing chamber 13 via an opening 17. The device further comprises a drainage pipe 15 attached to the lower part of the inner part 8a of the injection chamber 8. The device also comprises a valve 16 which is located downstream of valve 10 for extracting steam. In order to make the device even more efficient two or more pipe systems 4, preferably helical could be arranged in the container 2.

Water is introduced via the reducing valve 5 and then reaches the burner 3. It flows in the helical pipe and is pre-heated and then continues to the steam pressure chamber 6 where the water starts to boil and reaches a high pressure. The steam created continues to the safety valve 9, where the steam goes right through if not, for some reason a stop has occurred. If that is the case an overflow pipe 11 leading down to the burner 3 turns it out. The burner 3 is designed in such a way that if the flame goes out a small heat sensor automatically turns off the gas or the corresponding. If the safety valve is not triggered the steam continues to a vent passage 10 which functions in such a way that as soon as the steam has entered and reached a certain temperature, at 8 bar it is approximately 180°, it opens automatically and lets the steam pass through. If, by any circumstance, the burner 3 would not react properly the vent passage closes. This is however highly unlikely considering the capacity of the burner 3. The pipe coming from the vent passage 10 enters directly into the injection chamber 8, which consists of an inner chamber where the steam is injected and an outer chamber surrounding the inner, where the exhaust gas is introduced. The exhaust gases keep the steam heated already at this stage. The steam rises to the mixing chamber 13, where steam and exhaust gases are mixed. The injection chamber can as an alternative consist of two hoses having a certain desired length depending on the application, one hose surrounding the other (steam-jacketed) and be injected just before it enters the mixture chamber 8. Condensation can be achieved in such a way that water flows which the steam can carry flowing down in a drainage pipe 15 and further down in the sink. If the burner 3 would go out the water is prevented from rising and flowing in to the burner 3. At the top of the steam genera-

tor a flame guard, designed as a perforated plate, is arranged, as a safety precaution, in such a way that the flames will not be able to rise higher. In addition there is a valve 16 located downstream of valve 10 for evacuating steam, so that the device can be used for example for cleaning of tanks for medicine manufacturing, at the end of the cleaning process, when it is desired to get the tank disinfected, by only injecting steam in the tank. Alternatively a two-way valve (not shown) could be connected to the injection chamber in such a way that the exhaust gas could be evacuated via this valve so that only steam is used in the end of a process as described above. In this way hotter steam can be achieved. There is also a steam heating hose 14, connected to the opening 17, provided for transporting the steam and exhaust gas mixture.

When the exhaust gases are injected into the steam they are intended for heating up desired cavities whereas the steam in the mixture is intended to loosen up the slag or the like on the surfaces in the cavity. During the process the steam, as it is mixed with the exhaust gases, prevents from fire due to heating by the exhaust gases. When the exhaust gases in the mixture have heated the cavity to the desired operating temperature, the steam in the mixture starts loosening up the slag on the surfaces while at the same time the exhaust gases keep the surfaces heated. Thus, the exhaust gases transports the steam and keeps it warm in an efficient way. This results in a very high efficiency, with practically no loss of energy.

Fig. 1b shows schematic view of a device 1' for heating by means of a gaseous medium comprising steam according to a second preferred embodiment of the present invention, where the burner is located inside the container at the top. The device comprises the same features as the device 1 according to fig. 1a and functions in the same way. It only differs in that the burner is located at the top. An advantage by arranging the burner at the top as shown in the device according to fig. 1b is that, when operated, the burner 3 of the device is arranged to force the exhaust gas down before it returns and enters the injection chamber 8, which means that the wa-

ter/steam in the pipe configuration receives heat from said exhaust gas on its way down in the container 2 and by returning through the container 2 into said injection chamber, which means that the device becomes more efficient.

Fig. 2 shows a device for heating by means of a gaseous medium comprising steam according to an alternative embodiment of the present invention. The device comprises a container 20 having an air inlet 21, a gas inlet 22, a water inlet 23, a steam outlet 24, an exhaust gas outlet 25 and an outlet 26 for the steam and exhaust gas mixture, and a burner 3, for burning a fuel, for example combustion gases, located inside the container 20. The burner 3 is intended to be supplied with air through the air inlet 21, preferably from a fan, and with combustible gas such as propane, butane, natural gas or the like through the gas inlet 22. The air inlet 21 and the gas inlet 22 are arranged in such a way that the air is mixed with the gas, which is ignited whereby a gas flame appears. The water inlet 23 is arranged in such a way that the water fed through the water inlet 23, which preferably is a pipe shaped as a spiral inside the container 20, is heated by means of the burner 3 to steam-generating heat. The steam outlet 24 and the exhaust gas outlet 25 are arranged in such a way that they form a common cavity 26 where steam formed from the heated water in the spiral and exhaust gas produced from burning the combustion gases are intended to be mixed and further be introduced into a cavity, such as a ventilating duct, through the outlet 27.

Fig. 3 shows an example of an application according to the invention, using the device in fig. 2, where the mixture of exhaust gas and steam is introduced from the outlet 27 into the entire length of a channel 30 such as a ventilating duct 30 starting from the bottom and out through the upper part of the ventilating duct 30 by means of automatically heating controlled exhaust valves 31. The mixture of exhaust gas and steam heats the inside of the ventilating duct from 10°-90° with a mixture of steam and exhaust gas of 140°-200°, which melts the impurities 32 such as fat and oil deposits 32 on the inside of the ventilation duct 30. The melted fat and oil depos-

its 32 flows due to their own weight down to the bottom of the ventilating duct to the pipe for runoff of fat and oil to a collecting vessel 33 for fat separation, where fat and oil are cooled and transforms into solid state and can easily be disposed of.

Steam, which is cooled in the process, reverts, i.e. is condensed to water and flows back in the lowest part of the ventilating duct and is collected in the collecting vessel 33 ready to be removed after having finalised the cleaning of the ventilating duct.

During the process the mixture is risingly led to the top of the channel where preferably a temperature regulated valve 31 is located. The valve 31 is arranged to be controlled by temperature in such a way that the inner sides of the ventilating duct 30 are supplied with a proper amount of exhaust gas and steam for reaching a temperature for melting the impurities consisting of fat, oils mixed with dust, soot and slag particles, which are stuck on the inner sides of the ventilating duct 30. The control of the valve 31 is designed in such a way that the gas and steam mixture is maximally used for the cleaning of the channel regarding supplied energy.

As implied above the exhaust channel can be a ventilating duct such as a kitchen duct, or a chimney or the like. The device according to the invention, however, facilitates introducing the mixture into any kind of cavity, where the cavity apart from an exhaust channel can be e.g. a tank; drainage system; chimney; boiler; pipeline; oil container; oil well; oil shale; oilslick or the like. Different applications of the invention will be further elucidated below.

The device according to the present invention can thus in another application be used for, in a quick, efficient and safe way, removing slag from the inside of the boilers in boiler houses or the like.

The device can in a further application as mentioned above be used for, in a quick, efficient and safe way, removing fat from the inside of exhaust air ducts such as kitchen ducts or the like. By introducing the steam and exhaust gas mixture into the channel the fat becomes as loose as cooking oil, floats down and is collected in a container at the bottom. The fat is then preferably cooled down and becomes hard, and can easily be removed. This is explained further above.

The device can in a further application be used for, in a quick and efficient way, removing slag from the inside of channels by food manufacturing such as chocolate channels by chocolate manufacturing or the like. By introducing the steam and exhaust gas mixture into the channel the slag products are liquefied and can be removed. This is by way of example. The invention can of course be used in any cavity where fat, for example vegetable fat, is present.

The device can in a further application be used for, in a quick, efficient and safe way, removing soot from the inside of industrial chimneys or the like. The top of the chimney is sealed. The mixture with a suitable temperature is then introduced. By the heat the soot becomes heavy and falls down, is shoved together and can then easily be removed by transport.

The device can in a further application be used for, in a quick and efficient way, removing slag from the inside of tanks by medicine manufacturing or the like which is quick and efficient. By introducing the mixture at preferably 125-140° the slag products are removed and the tank is disinfected and ready for use. In order to get the tank fully disinfected only steam is injected at the end, or alternatively the exhaust gases are diverted at the end such that only steam is released. This can also be done with a petroleum tank, which then eliminates the risk of fire.

The device can in a further application be used for, in a quick, efficient and safe way, removing hard paper pulp from the inside of containers by paper pulp manu-

facturing or the like. By introducing the mixture in the container the hard paper pulp stuck on walls is loosened up by the heat and can easily be removed such that the container again is ready for use.

The device can in a further application be used for, in a quick and efficient way, without damaging the pipes, cleaning drainage systems such as cast iron systems or the like in apartment buildings or the like. By introducing the steam and exhaust gas mixture into the pipes they are cleaned very efficiently without any risk of being damaged in the process. One way of doing this is to attach a pipe tee to the outgoing pipes, presumably located in the basement, then connecting the device for producing the mixture, and then, using the temperature regulator on the roof, introducing the steam and exhaust gas mixture, heating the drainage and consequently the fat without pressure floats down into a collecting barrel or the like.

The device can in a further application be used for, in a quick and efficient way clearing oil stuck in pipelines. By introducing the mixture in the pipelines the oil stuck in the pipelines is cleared. How big a section of the pipeline that can be cleared depends on the size of the gas burner or the like. Theoretically a section of up to one kilometre could be cleared. One way of practically doing this is to use trucks for accessing the pipelines, onto which trucks the mixture device and a water container are arranged.

The device can in a further application be used for, in a quick and efficient way preventing boring bars to get stuck by drilling in oil wells. The boring bars get stuck because of the oil being cooled down due to the thermal rising force from the geothermal heat, i.e. hot air, which when moving at high speed gives a cooling effect. By introducing the steam and exhaust gas mixture into the ground the oil is prevented from being cooled down and thus the risk of the boring bars getting stuck is eliminated.

The device can in a further application be used for in an efficient and power saving way extracting shale oil in shale oil reserves. The shale oil lies under ground as bitumen. Instead of introducing steam in order to liquefy the bitumen, requiring a lot of power, the steam and exhaust gas mixture is introduced, requiring much less power. The presence of bitumen lies in many cases under natural gas reserves, and thus in these cases by combusting the natural gas, it can then be mixed with steam for producing the steam and exhaust gas mixture. The combustion gas is thus in these cases "free of charge".

The device can in a further application be used for in an efficient way collecting the oil from a sunk or sinking oil tanker. In the case of sinking oil tankers the water is usually so cold that the oil starts sinking to the bottom. By introducing the mixture into the oil compartment in the sinking oil tanker via hoses and heat up the oil, it can easily be retrieved.

The device can in a further application be used for in an efficient way collecting the oil from an oilslick. By covering the oilslick with a blanket or the like, and the introducing the steam and exhaust gas mixture under the blanket and into the oilslick, the oil is heated and becomes more liquid. The temperature of the oil is preserved by the blanket, and thus the liquid oil can easily be sucked up.

Fig. 4 shows a system for heating by means of a gaseous medium comprising steam according to an aspect of the present invention. The system 50 comprises an arrangement 200 for mixing steam with exhaust gas from combustion of a fuel, where said fuel is constituted by a gaseous medium, for example butane, propane, natural gas or the like, or a liquid medium, for example diesel, oil or the like, or a solid medium, for example coal, pellets, peat, oilshale, coke, wood or the like, or a mixture thereof, and where said arrangement is intended to comprise any kind of unit, device, system, process plant, factory, engine or the like intended for burning a fuel, for example a gas burner, an oil burner, a turbine, a combustion engine, piston en-

gine, an incinerator or the like including the device 1, 1' according to fig. 1a, 1b, 2 or similar. The system 50 further comprises a heat exchanger 51 connected via a first opening 52a thereof to the outlet of the device 200. Preferably a fan 53 is arranged between the outlet of the device and the first opening 52a of the heat exchanger 51 in order to build up pressure when desired. Said heat exchanger 51 further comprises an inlet 54 and an outlet 55, into which inlet 54 e.g. tap water is arranged to be introduced through e.g. a pipe 56, said pipe 56 being arranged within the heat exchanger and runs through the inside thereof to said outlet, the pipe 56 preferably having a helical form inside the heat exchanger 51, in order to optimize exchange of heat. The system further comprises a passage 57a which is connected to a second opening 52b of the heat exchanger 51, for discharging light impurities, for example CO_2 through said passage 57a, and a condensation pipe 57b which is connected to a drainage 58 of the heat exchanger 51 for discharging the condensed mixture including heavy impurities and part of the light impurities, said drainage 58 being located in the lower part of the heat exchanger 51, the condensation pipe 57b having a certain inclination leading downwardly to a substantially vertical pipe configuration 59 to which it is connected, said pipe configuration 59 extending above the level of the condensation pipe 57b. By light impurities is meant all compounds, particles or the like produced by burning any kind of fuel which are light such that they will escape from said condensed mixture, and by heavy impurities is meant all compounds, particles or the like which remains in the condensed mixture, for example CO_2. The system 50 also comprises a collecting vessel 60 for receiving light impurities, for example CO_2, connected to said passage 57a and said pipe configuration 59, located at the top of the pipe configuration 59. The system 50 further comprises a water filter 61 arranged within the pipe configuration 59 at a level below the condensation chamber 57, an accumulator tank 62 connected to the pipe configuration downstream of the water filter 61, and a circulation pump 63 connected to the pipe configuration 59, said pump 63 being arranged to circulate the water and force the water back to the device 200.

When operated tap water of a temperature of e.g. 6°C is introduced into the arrangement 200 through the pipe 4 and the water is heated to a desired steam temperature and the achieved steam is mixed with the exhaust gases for example in a manner as described above in conjunction with fig. 1a. The mixture is then introduced into the heat exchanger 51 through the opening 52a, where the fan 53 is arranged to build up a desired pressure of the mixture. Normally the system 50 would also function without the fan 53. Water of e.g. 6°C, is introduced via the inlet 54 of the heat exchanger, which runs through the pipe 56 to the outlet 55. The water in the pipe 56 present within the heat exchanger 51 is heated up by means of the hot mixture of exhaust gas and steam, which mixture then at the same time is cooled by the water in the pipe 56 and eventually condenses. The condensed mixture flows by means of gravity down through the drainage 58 at the bottom of the heat exchanger, through the condensation pipe 57b and into the pipe configuration 59. Light impurities, for example CO_2, are released through the second opening 52b and are collected in the collecting tank 60. In the pipe configuration, light impurities, e.g. CO_2, which follow the condensed mixture through the condensation pipe 57b to the rises up through the pipe configuration 59 and are also collected in the collecting vessel 60, and heavy impurities flow down with the water to the water filter 61, e.g. active coal or the like, which collects the heavy impurities. The filtered pure water is then introduced into the accumulator tank 62 in order to avoid the system 50 running empty. The circulation pump 63, preferably located downstream of the accumulator tank 62, pumps the water back into the device 200, the temperature of the water now being of substantially higher temperature compared to when initially introduced into said device, which consequently means that less energy is required to heat up the water for a second time. The process is then repeated.

In this way a closed system is achieved, which reuses the water, collects light impurities, for example CO_2, and heavy impurities so that there is no release to the environment, and which has a very high efficiency. Through the outlet 55 of the heat exchanger 51 hot water or steam of a desired temperature, the outlet temperature of the

hot water or steam depending on the temperature of the steam and exhaust gas mixture, can be retrieved, which can be used for heating purposes as described below.

Fig. 5 shows an aspect of the present invention where the above system is applied to a central boiler plant, which supplies district heating to buildings and the like. By applying the system to e.g. a central boiler plant, approximately 30-50% less effect, the efficiency depending for example on the efficiency of conventional apparatus comprised in said system and on the efficiency of e.g. the central boiler plant, would be required to receive the same amount of energy. The system is preferably connected in such a way that the outlet 55 of the heat exchanger 51 of said system 50 is connected to at least one unit 64, preferably a central boiler plant 64, a heat exchanger or the like, into which hot water of e.g. 120-140°C is introduced. The central boiler plant 64 then in a conventional manner supplies heat to buildings 67 or the like, i.e. the hot water flowing through the central boiler plant 64 is cooled and has a temperature of e.g. 110°C leaving said second heat exchanger. The hot water is then supplied to the radiator systems of houses 67 via pipes 68. Tap water is at the same time introduced into the inlet 65, and the heated water is then supplied from the outlet to the pipe systems for supplying hot water to the taps and showers of the houses 67. The return water, preferably having a low temperature, is then reintroduced into the inlet 54 of the heat exchanger 51, and the process starts all over.

Instead of applying the system to a central boiler plant it could be applied to each separate building, or to a number of buildings, such that each building or number of buildings has its own system for heating. In this case devices requiring less power are needed, and the heat does not have to be transported such a long way as in the example above.

The above system can consequently be used for, in an efficient way, heating up rooms such as e.g. house trailers. As described above the steam and exhaust mixture is introduced into a heat exchanger. The steam rises and heats the water in the heat

exchanger until the steam has been cooled down to the temperature where condensation occurs. The steam flows down again and the process starts all over. By cooling the exhaust gases in the form of accumulated water below the dew point it flows down again. The old exhaust gases are filtered via water filters such that they can be re-used, i.e. no exhaust opening such as a chimney or the like is needed, and consequently no exhaust gases are released to the environment. Instead of using e.g. water with a temperature of e.g. 6° C, water with a temperature of e.g. 20° C is received. Therefore, as it is a closed system, the heating process becomes faster. A very high temperature difference (ΔT) is achieved. By filtering in e.g. normal active coal pure water is provided again.

Fig. 6 also shows another aspect of the present invention where the above system is applied to a steam turbine 70. As an example the steam and exhaust gas mixture is by means of heating given a temperature of approximately 700°C, which mixture is introduced in the first heat exchanger 51. In the system 50, steam having a temperature of approximately 600-680°C and a pressure of approximately 200-250 bar, is then taken out from the outlet 55 of the first heat exchanger 51 and is introduced into a steam turbine 70, which is used in a conventional way for the production of electrical power 72. A second heat exchanger 71 or the like is connected to the turbine 70 such that steam from the turbine 70 is intended to be introduced into said second heat exchanger 71. Tap water is run through the heat exchanger via an inlet 74 and an outlet 75, where the heated water retrieved from the outlet may be used for heating purposes. The steam introduced in the heat exchanger is cooled by means of the tap water, and the cooled water is returned via a return pipe 73 to the inlet 54 of the first heat exchanger 51, and the process starts all over.

Fig. 7 shows system 80 for purification according to still another aspect of the present invention. The system comprises an arrangement 200 for mixing steam with exhaust gas from combustion of a fuel, where said fuel is constituted by a gaseous medium, for example butane, propane, natural gas or the like, or a liquid medium,

for example diesel, oil or the like, or a solid medium, for example coal, pellets or the like, or a mixture thereof, and where said arrangement comprises at least one first unit 81 which is constituted by any kind of device, system, process plant, factory, engine or the like intended for burning a fuel, for example a gas burner an oil burner, a turbine, a boiler, a combustion engine, i.e. a car engine, a boat motor, a piston engine, an incinerator or the like including the device 1, 1' according to fig. 1a, 1b, 2 or similar. The system 80 further comprises a passage 82 connected to said first unit 81, through which passage 82 exhaust gas flows, a pipe configuration 83 through which steam, preferably produced from heating water by means of heat from said unit 81, e.g. from said exhaust gases, flows, a chamber 84 to which both the exhaust gas passage 82 and the steam pipe 83 are connected, in which chamber 84 the steam is injected and mixed with the exhaust gas such that a mixture 100 is achieved. The system also preferably comprises at least one second unit 85 which is constituted by any kind of device, system, process plant, factory or the like discharging non-combusted gases of any kind, for example from paint or other chemical compounds, said unit being connected to a passage 95 through which the non-combusted gases are intended to flow. The system further comprises a second chamber 96 into which the steam and exhaust gas mixture is intended to be introduced via a passage 94, and into which said non-combusted gases are intended to be introduced via said passage 95 such that a mixture 150 is achieved. The non-combusted gases are intended to be mixed with the steam and exhaust gas mixture 100 in said second chamber 96. The system still further comprises a heat exchanger 87 into which the steam, exhaust gas and non-combusted gas mixture is intended to be introduced and cooled down. The system 80 also comprises, similar to the system of fig. 4 a passage 88a which is connected to an opening 89a of the heat exchanger 87, for discharging light impurities, for example CO_2 through said passage 88a, and a condensation pipe 88b which is connected to a drainage opening 89b of the heat exchanger 87 for discharging the condensed mixture including heavy impurities and part of the light impurities, said drainage opening 89b being located in the lower part of the heat exchanger 87, the condensation pipe 88b having a certain inclination

leading downwardly to a substantially vertical pipe configuration 93 to which it is connected, said pipe configuration 93 extending above the level of the condensation pipe 88b. The system 80 further comprises, as in the system 50 of fig. 4, a collecting vessel 90 for receiving light impurities, for example CO_2 located at the top of the pipe configuration 89, a water filter 91 arranged within the pipe configuration 89 at a level below the heat exchanger 87, and a circulation pump 92 connected to the pipe configuration 89, said pump 92 being arranged to circulate the water and force the water back to the unit 80, where it can be reused.

In this way chimneys in factories or the like become obsolete and practically no exhaust gases or non-combusted gases are discharged into the environment. Light impurities, for example CO_2 is further taken care of in a controlled manner.

The heat exchanger 87 further comprises an inlet 98 and an outlet 99, into which inlet 98 tap water is intended to be introduced. The hot water or steam leaving the outlet 99 can be used for heating purposes according to for example the examples shown in fig. 5 or 6.

The system 80 may of course be used for purifying only exhaust gases which for example can be achieved if the unit 85 constitutes any kind of device, system, process plant, factory or the like discharging exhaust gases of any kind, or simply by disconnecting the unit 85. In these cases the mixture in the chamber 96 is constituted by the steam and exhaust gas mixture 100.

The device can in a further application be used for in an efficient way put out fires. The device facilitates, by mixing steam with exhaust gas, achieving dry, saturated steam/exhaust gas mixture having a low pressure and a temperature of e.g. 300 – 400°C, which gives ideal characteristics for extinguishing fires. By introducing the steam from the device from underneath, the core of the fire is reached without getting in contact with the flames. The fire is then put out from underneath and the

oxygen is taken away at the same time as it moistens all the surfaces. Either a perforated hose is used which is unrolled in the floor underneath, or alternatively a hose is harpooned or similar into the floor being on fire.

Fig. 8a shows a system 110 for extinguishing fires which occurs by oil drilling, and fig. 8b shows a detail of said system. The system 110 comprises a steam jacketed casing pipe configuration 111, comprising an inner casing 112 and an outer casing 113, which pipe configuration 111 is intended to be closely received in a bore hole, said pipe configuration 111 having a length of preferably 2-20 metres, more preferably 5-10 metres. The outer casing 113 of said pipe configuration 111 is substantially cylindrical, and preferably has a larger diameter than a normal boring hole, which means that the diameter of the boring hole should have a diameter, which is sufficiently wide to receive the steam jacketed casing pipe configuration 111, along the length thereof. The outer casing 113 and the inner casing 112 of the pipe configuration 111 form chambers 114 axially provided along the pipe configuration 111. The chambers 114 are axially connected via openings 115, said openings 115 having a diameter slightly larger than the diameter of the bore. The inner casing 112 comprises openings 117 into each chamber. The system 110 further comprises an arrangement 200 for mixing steam with exhaust gas from combustion of a fuel, where said fuel is constituted by a gaseous medium, for example butane, propane, natural gas or the like, or a liquid medium, for example diesel, oil or the like, or a solid medium, for example coal, pellets or the like, or a mixture thereof, where said arrangement may constitute the device 1 according to fig. 1a or 1b or similar device for mixing steam and exhaust gas. The dry, saturated, steam and exhaust gas mixture is intended to be introduced from the top of the pipe configuration into the cavity 116 between the inner and the outer casing and forced down by pressure means to the bottom of said pipe configuration. The mixture is arranged to flow through the openings 117 into each chamber 114.

When there is a fire in the bore hole a steam and exhaust gas mixture 100 is, by means of pressure, introduced into said cavity from the top of said pipe configuration, said pressure being achieved by means of for example a fan or the like, where said pressure is higher than the pressure of the inflammable gas coming up through the bore hole, such that said mixture 100 enters, through the openings 117, each chamber 114, in which chambers the steam binds said inflammable gas. Due to the dry, saturated steam and exhaust gas mixture the fire is then extinguished and the mixture also prevents a new fire to begin. In this way no damage to the bore hole is caused. The pressure of the inflammable gas coming up through the bore hole can easily be measured with any kind of suitable pressure detecting means.

Above the invention has been described in connection with preferred embodiments. Of course further embodiments as well as minor changes and additions may be imagined without deserting the basic inventive idea.

The above mentioned applications of the invention are only examples. There are of course other areas where the invention offers advantages. In the oil industry, apart from what is mentioned above, also, for example, cleaning of oil tanks and cleaning of the ventilating ducts leading the oil mist away for the refining. In the marine industry, cleaning of heat exchange systems, cleaning of exhaust gas channels/ chimneys from engines etc., cleaning of drainage systems in there entire length, cleaning of tanks from oil, disposals and night soil, and cleaning of kitchen ducts from restaurant kitchens, are examples of applications. In the food industry cleaning and disinfection of preparation vessels, cleaning of ducts, and cleaning of production lines etc. Manufacturing of medicine is as mentioned cleaning and disinfection of preparation tanks. In building facilities for example, thawing of down pipes and spouts during winter season and as mentioned cleaning of drainage pipes. In paper pulp industry, cleaning of exhaust air duct systems is another application. In areas where today conventional steam engines are used, as e.g. thawing of road culverts, street gullies, water and drainage pipes, bore holes, casting moulds etc. Other areas are

hardening of concrete during the winter season, heating of large PVC pipes and many others.

Where temperatures, pressures, efficiencies are mentioned they have been included for the purpose of increasing the intelligibility of the application and are only examples and do consequently not have any limiting effect on the interpretation of each element.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.